

*Final Report
7/12/94 - 08/16/96
NAS8-38609*

OPTICAL FABRICATION

&

MEASUREMENT

AXAF & CIRS

Final Report

7/12/94 - 08/16/96

Contract No. NAS8-38609, D.O. 123

Submitted to:

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Marshall Space Flight Center Alabama, 35812

Submitted by:

Center for Applied Optics
The University of Alabama in Huntsville
Huntsville, AL 35899

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TASK 1.0: Preparation and Characterization of Zerodur Glass Samples

Mr. Greg Martin and Mr. Joe Pour have spent the majority of their time assisting NASA MSFC personnel in the fabrication and polishing of Zerodur low expansion glass samples. This material has been cut into the synchrotron bar configuration and polished to sub-nanometer rms surface finish. This includes the completion of the equipment set-up and testing in building 4487. They have completed the fabrication and polishing of Zerodur low expansion glass samples. This material has been cut into the synchrotron bar configuration and polished to sub-nanometer rms surface finish. This includes the completion of the equipment set-up and testing in building 4487.

Mr. Martin has performed the polishing and inspection operations while Mr. Pour has provided mechanical component fabrication support for the required polishing and measurements fixtures and tooling for the bar fabrication.

TASK 2.0: Develop and Fabricate AXAF & CIRS Metrology Tooling

Mr. Pour has provided machine shop support to expedite the fabrication of inspection and support tooling for AXAF. This includes the mirror x-ray inspection set-up as well as tooling for the calibration of the inspection systems. He has provided machine shop support to expedite the fabrication of inspection and support tooling for AXAF. This includes the mirror x-ray inspection set-up as well as tooling for the calibration of the inspection systems. Mr. Martin and Mr. Pour have assisted Ron Eng, Tom Kester and Raj Kanijow in the set-up and alignment of the TMA test base. This instrumentation will be used for the verification and quantification of the actual AXAF flight optics performance.

This effort has involved the disassembly and cleaning of sub-components of the TMA prior to reassembling in the class 100 clean room. The final assembly in the clean area will be in preparation for the final AXAF acceptance testing later this summer. This preparation has also required the assistance of Mr. Martin and Mr. pour for the support of AXAF with various optical and mechanical assemblies.

TASK 3.0: Update AXAF Technical Data Base

Mr. Lamar Hawkins has been in transition to work on x-ray mirror performance analysis and design criteria. He has worked on the data base to complete the AXAF-HDOS data base. He has also instructed MSFC secretarial staff on the use of the data base. He has now completed this task and is presently assigned to the new contract. Mr. Lamar Hawkins has worked on the AXAF-HDOS data base. He has also instructed MSFC secretarial staff on the use of the data base. He has now completed this task and is presently assigned to a new contract.

TASK 4.0: Perform Fabrication Related Metrology Tasks for CIRS

Mr. Martin has been involved with MSFC personnel to assist in the performance of metrology on the CIRS Goddard Space Flight Center Cassini mirrors. This involves a large

number of set-up and measurements including ZYGO and Profilometry analysis. This data has been continuously collected and updated throughout the quarter. The information has lead to the completion of the first set of these mirrors. Mr. Martin has been involved with MSFC personnel to assist in the performance of metrology on the CIRS Goddard Space Flight Center Cassini mirrors. He has completed his part on this activity.

Final Activities from July, 1996 Report to August 1996

The final cleaning, assembly and testing of the TMA has been completed. Final acceptance testing of the actual AXAF optics has been performed. All of the equipment has now been moved and reassembled in Building 4487. Upgrading and modifications will continue on another contract. The VGS optical filter efforts are up to date and will be continued on the next effort.

Sample studies of the electroless nickel, titanium nitride, chromium carbide and selected alternate ceramic coatings prepared by Balzers for D. Engelhaupt and Dr. Michele Wilson have been evaluated. The coating substrates (approximately 40 total) of 410 stainless steel were prepared for experimental evaluation. The substrate finish achieved prior to coating was very good with subnanometer finishes on most. The ceramic coatings applied to these substrates were lapped and measured with typically less than 20 angstrom rms surface finish achieved. However at the subnanometer level only two were serious candidates for x-ray mirror mandrel surfaces at about 8 -10 angstroms for the TiN. The samples chipped and severely scratched when polished with diamond but behaved well for both silicon carbide and aluminum oxide polishing media. These materials removed the TiN only very slowly however due to the extreme hardness. Sample measurements of SiC sample from China Lake demonstrated that less than 3 Angstroms rms was achieved. This was better than the mirror in the WYKO interferometer so special methods were developed for the measurements.

Additional polishing, metrology, tooling and materials characterization has been performed to support both the replicated optics and NGST efforts. This effort also supported much of the time by Mr. Martin for extended work related to the relocation of the Optical Fabrication Laboratory.

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Joe Pour

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